Albania

Drin River Hydropower Stations Rehabilitation Project

External Evaluator: Kenichi Inazawa, Office Mikage, LLC

1. Project Description

Map of the Project Area

Fierza Hydropower Station
(Power Generation Building and Dam)

1.1 Background

In Albania, a number of hydropower stations were built as a part of the water resource development policy implemented by the former socialist regime. However, most of them were built in the period between the 1950s and 70s, and rehabilitation was required due to aging infrastructure. Meanwhile, an increase in power demand, mostly for household consumption, had been expected after 1995. At that time, Albania struggled with a shortage of funds to develop the domestic power sector to meet the surging power demand, as the country was then transitioning to a market-oriented economy. Immediate actions to stabilize the power supply were sought. Under these circumstances, rehabilitation efforts were launched for existing domestic hydropower stations, with the help of loans provided by international aid organizations.

1.2 Project Outline

The objective of the project is to strengthen power generation capacity and increase its production, by rehabilitating and modernizing the existing hydropower stations (Fierza Hydropower Station and Vau i Dejes Hydropower Station) such as upgrading mechanical, electrical and control equipments, converting the existing equipments into high grade ones;

thereby contributing to stabilize the supply of power and economic growth in Albania.

Approved Amount/Disbursed Amount	1,681 million yen/1,681 million yen
Exchange of Notes Date/Loan Agreement Signing Date	October 1995/November 1995
Terms and Conditions	Interest Rate: 2.6% Repayment Period: 30 years (Grace Period: 10 years) Condition for Procurement: General Untied
Borrower / Executing Agency(ies)	Albania Power Corporation (KESH)/ Albanian Power Corporation (KESH) Guarantor: Government of the Republic of Albania
Final Disbursement Date	December 2006
Main Contractor (Over 1 billion yen)	ABB SAE Sadelmi S.p.A. (Italy)
Main Consultant (Over 100 million yen)	N/A
Feasibility Studies, etc.	F/S prepared by Lahmeyer International (Germany) (1993)
Related Projects (if any)	Drin River Cascade Rehabilitation Project (1995-2007) (Entire project covered mostly by EBRD loans[1])

2. Outline of Evaluation Study

2.1 External Evaluator

Kenichi Inazawa, Evaluation Consultant, Office Mikage, LLC

2.2 Duration of Evaluation Study

Duration of the Study: April, 2010 – February, 2011

Duration of the Field Study: June 22–30, 2010 (1st study)

October 4–8, 2010 (2nd study)

2.3 Constraints during the Evaluation Study

N/A

[1] Name of the entire project mostly covered by the loan from European Bank for Reconstruction and Development (EBRD), including a portion covered by a JICA loan (this project). (For more information, see Table 1 on page 5. Portion covered by EBRD loan: utility construction work for the power station, rehabilitation for the control systems, etc. Portion covered by the grant aid provided by the Swiss and Austrian governments: rehabilitation and other activities for water mechanical equipment for intakes and conduits.

3. Results of the Evaluation (Overall Rating: B)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of Albania

Albania undertook economic restructuring in 1990 when it introduced market competition principles and achieved increased GDP growth in 1993. Aided by the IMF's Enhanced Structural Adjustment Facility (ESAF) in 1993, the Albanian government formulated a policy called the Medium-term Macro-economic Policy (1993–1996). The main focus of the policy was cultivating core elements of external economic policy by facilitating exports and attracting direct investments. Under these circumstances, electric power was recognized as a major export item for Albania as well as a leading infrastructure that would attract direct investment from the outside world. Additionally, the Albanian government formulated the Public Investment Plan (PIP), in which the power sector was placed as a high priority.

At the time of the ex-post evaluation, the Albanian government (Ministry of Economy, Trade and Energy) formulated the National Energy Strategy in May 2007 to promote energy development, with the aim of resolving domestic power demand issues in the country. In addition, the government also formulated a 2009–2011 policy for the power sector and an energy program by approving the Ninth Power Sector Action Plan in February 2009. As a result, even at the time of the ex-post evaluation, the power sector has continued being considered important. Therefore, consistency of policies and measures with this project both at the time of the appraisal and the ex-post evaluation can be recognized.

3.1.2. Relevance with the Development Needs of Albania

At the time of the appraisal (1995), Albania was using its rich water resources to generate power and exporting it to other countries. In 1992, the value of the country's exported power was 16 million US dollars, equivalent to some 25% of the country's total exports. However, in the next year, that value dropped to 5 million US dollars due to the increased domestic power demand, a figure equivalent to some 5% of the country's total exports. Meanwhile, it was anticipated that the country's household power consumption would rise sharply, by approximately 13–16%, in 2001. Therefore, it was also anticipated that Albania's power demand would exceed its production, since the power generation capacity was still restricted.

At the time of the ex-post evaluation, the total domestic power generation has increased in comparison with its level at the time of the appraisal. The total domestic power generation was

around 3,400GWh at the time of the appraisal, which has increased to around 5,200GWh[2] at the time of the ex-post evaluation. Overall power consumption, mainly by household, increased by 1% each year in the last decade, and thus further increases in power demand are predicted. Additionally, the Dam Safety Project was recently launched, mainly with the help of a World Bank loan,[3] for the purpose of ensuring the safety of dams for domestic hydropower generation, improving operations, and stabilizing the power supply.

Therefore, it can be assumed that Albania will continue to have a pressing need to develop its hydropower generation capacity.

3.1.3. Relevance with Japan's ODA Policy

The Official Development Assistance Charter (ODA Charter) approved by Japan's Cabinet in 1992 states, "Attention should be paid to efforts for promoting democratization, the introduction of a market-oriented economy and the situation regarding the protection of basic human rights and freedoms in the developing countries." Since this project aims to support Albania's shift to a market-oriented economy, it is considered relevant to Japan's foreign aid policy.

This project has been highly relevant with Albania's development plan and development needs, as well as to Japan's ODA policy, therefore, its relevance is considered high.

3.2 Efficiency (Rating: c)

3.2.1 Project Outputs

1) Planned and Actual Outputs of the Entire Project

Table 1 shows planned and actual outputs and lists the sources of funding for the entire project. The main focus of the project was to rehabilitate Albania's largest hydropower stations, Fierza Hydropower Station and Vau i Dejes Hydropower Station,[4] with the aid of the European Bank for Reconstruction and Development (hereinafter, EBRD) loan, JICA loan, and grant aids from the Swiss and Austrian governments. Under the terms of the EBRD loan, utility civil works of the power stations and rehabilitation of the control systems were planned, while the

[2] Actual data in 2009.
[3] To be completed in 2013.
[4] Total output capacity is: Fierza Hydropower Station, 500MW (4 generator units of 125MW); Vau i Dejes Hydropower Station, 250MW (5 generator units of 50MW). Both are general hydropower stations. The generator units were made in China, and the turbine generator model is a vertical-shaft Francis Turbine. For reference, Japan's largest hydropower station with the same generator model is the Arimine-Daiichi Power Station (1 generator unit of 265MW) of the Hokuriku Electric Power Company.

JICA loan planned for rehabilitation of power generator units and replacement of electrical equipment installed in the power generation chambers and substation facilities. Furthermore, with the help of grant aids provided by the Swiss and Austrian governments, rehabilitation of water mechanical equipment for intakes and conduits was planned. The output of the project as a whole was implemented as planned.

Table 1: Planned and Actual Outputs and Sources of Project Funding

Rehabilitation Project of Fierza Hydropower Station	
Planned (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
1) Utility civil works (ground utilities) ->EBRD loan and Albania's own funds 2) Mechanical equipment (intake, conduit, new runners, etc.) ->Grant aid from the Swiss government 3) Electrical equipment (see upper row of Table 2) ->JICA loan 4) Instrumentation and control equipment ->EBRD loan	1) 2) 3) 4) Implemented as planned
Rehabilitation Project of Vau i Dejes Hydropower Station	
Planned (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
1) Utility civil works (ground utilities) ->EBRD loan and Albania's own funds 2) Mechanical equipment (intake, conduit, new runners, etc.) -> Grant aid from Austrian government 3) Electrical equipment (see lower row of Table 2) ->JICA loan 4) Instrumentation and control equipment ->EBRD loan	1) 2) 3) 4) Implemented as planned
Consulting Services (The Entire Project)	
Planned (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
->To be implemented with funds provided by EBRD. Activities include project preparation, tender evaluation, management of utility civil works, etc. (223M/M)	->Implemented as planned. (232M/M: slightly exceeded the planned value due to the additional need for design engineers and additional works caused by the extension of the project period.[5])

Sources: JICA documents, Answers on Questionnaires

[5] The Executing Agency commented that the additional consulting services remained insignificant in terms of volume since strict controls were placed on the project operation of consultants and fund control.

2) Planned and Actual Outputs of JICA Loan Portion

Table 2 shows planned and actual outputs regarding the JICA loan portion, across the entire project. The project was almost implemented as planned at the time of the appraisal: rehabilitation of power generation units (four units of Fierza Hydropower Station and five units of Vau i Dejes Hydropower Station) and replacement of electrical equipment installed in the power generation chambers and substation facilities.

Table 2: Planned and Actual Outputs Regarding JICA Loan Portion

Outputs	Planned (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
Fierza Hydropower Station	- Testing and upgrading of unit-transformers - Rewinding and stacking of 2 generator units - Testing of generator units - Replacement of excitation for 4 units - Upgrading of cooling system for 2 generators - Replacement of 220KV isolator switches (18x) - Improvement of A.C. and D.C. system - Upgrading of illumination system - Procurement of spare parts - Procurement of emergency diesel generator	Procurement, installation and replacement were implemented as planned.
Vau i Dejes Hydropower Station	- Testing and upgrading of unit-transformers - Replacement of unit protection system - Replacement of excitation systems - Replacement of A.C. and D.C. system - Replacement of 4 x 220kV-bays -Replacement of 1 x 110KV-bays - Upgrading of cooling system for 5 units - Testing of generator units - Improvement of illumination system - Procurement of spare parts - Procurement of emergency diesel generator	Procurement, installation and replacement were implemented as planned.

Sources: JICA documents, Answers on Questionnaires

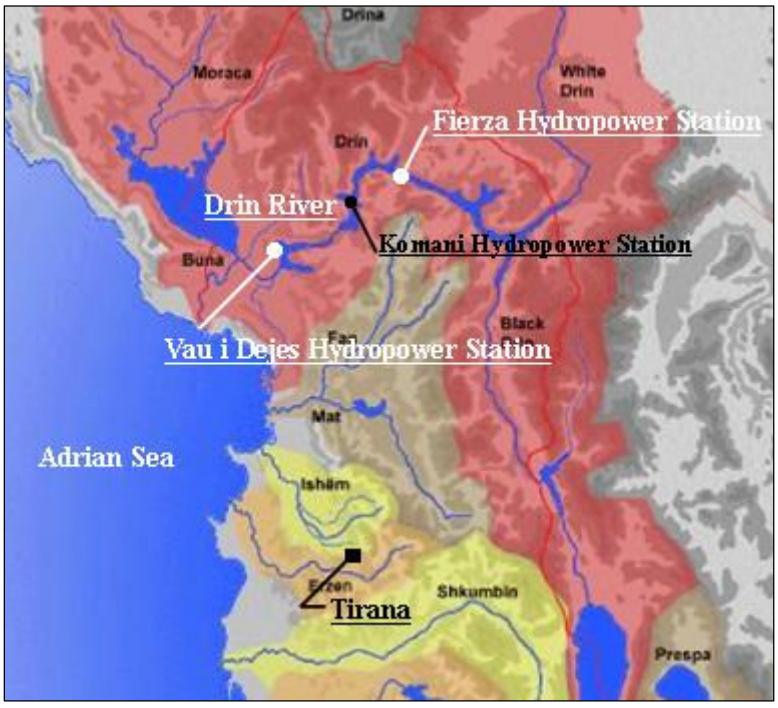


Figure 1: Project Site[6]
(Fierza Hydropower Station and Vau i Dejes Hydropower Station)

3.2.2 Project Inputs

3.2.2.1 Project Period

The planned project period was 47 months, from November 1995 to September 1999; however, it actually took 144 months, from November 1995 to October 2007,[7] 306% much longer than planned. The major reason of the delay is explained as follows:

1. Due to the worsened security condition, sparked by Ponzi scheme failures[8] in 1997, commencement of the construction was delayed by 9−10 months.[9]
2. EBRD held financing and loans in abeyance for a period of 38 months from April 1997 to May 2000, mainly due to the insufficient performance of the Executing Agency such as high transmission loss rate, low performance in collecting power charges, etc. This

[6] Shown in this figure, there are three hydropower stations on the Drin River. In fact, Komani Hydropower Station was out of the project scope.
[7] Rehabilitation of the Fierza and Vau i Dejes hydropower stations was completed in February 2007 and October 2007, respectively.
[8] Although Albania introduced a market-oriented economic system in the early 1990s, its financial system remained primitive. A significant number of Albanians invested in Ponzi schemes that had been condoned by the government. However, dividend payments fell behind schedule, and the scheme eventually went bankrupt in 1997, losing 1.2 billion US dollars. This triggered rebellions throughout the nation, reflecting increased disillusionment towards the government among Albanians. The government imposed a state of emergency to quell a rebellion (approx. 2,000 lost their lives in the disturbance). Albania was in chaos in that year.
[9] The tender period was extended by one month. This caused another 8-month delay until the construction agreement became effective.

led JICA to adjust their work schedule, including the timing of the loading, because the JICA loan portion (electrical equipment and devices, etc.) had to be correlated with the progress of the EBRD loan portion (control and monitoring systems).

3. In connection with the abeyance of financing and suspension of the project, in August 2008, a contractor in charge of the power-generating facilities demanded an additional fund from the Executing Agency as costs for the storage of delivered equipment and personnel secured during the time. After significant time was spent for the negotiation regarding the amount for the demanded fund and securing the additional budget, the additional agreement finally became effective in September 2002. As a result, the construction commenced by the contractor after 30 months of delay. (The actual construction on the site started in January 2003).
4. After the construction commenced, unexpected water leakage occurred from the power-generation and peripheral facilities. This caused a six-month delay. (The water leakage has already been resolved.)

As described above, the main reason for the delay in the project schedule was the abeyance of financing and loans from EBRD. In hindsight, however, it is questionable whether the implementation of co-financing/financial aid by multiple donors was really effective. According to the interview with the Executing Agency, “Albania at that time was unable to obtain necessary funding for the project without securing multiple donors for co-financing or funding. However, procuring methods for the facilities and equipments varied by donor and the related procedures were also complicated. Therefore, it is considered unavoidable that the project cost ended up exceeding the original plan due to the delay in processes.” This shows that, given the circumstances of multiple financing/funding, it is important both for donors and recipient countries to manage project progress and costs more carefully.

3.3.2.2 Project Cost

The planned cost was 4,387 million yen (JICA loan amount was 1,681 million), and the actual cost was 6,470 million yen (JICA loan amount was 1,681 million), which was higher than planned (about 147% of the plan). As explained in 3.2.2.1. (Project Period), the main reason that the actual project cost exceeded the planned cost was delays in the schedule for procuring facilities/equipment and commencement of the rehabilitation work. Specific reasons for the delays include: an increase in the Albanian government’s spending as a consequence of the

abeyance of financing and loans by the EBRD, which made a contractor of power-generating facilities demand additional funds to cover the cost of storage of delivered equipment and personnel secured during the time; unexpected costs arising from foreign exchange fluctuations; and disassembling work for generator units.

Table 3 shows the planned and actual costs of the project. As stated above, the Albanian government struggled to secure funds to cover the additional costs incurred in connection with delays in project progress. The additional costs were covered by loan assistance (Italy's ODA loan) provided by Italian Finance Corporation for Mid-Term Financing (Mediocredito Centrale: MCC).

Table 3: Total Project Cost (Planned at the Time of the Appraisal and Actual at the Time of the Ex-post Evaluation) (Unit: million yen)

Items	Planned (at the time of the appraisal)			Actual (at the time of the ex-post evaluation)		
	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total
1. Fierza Hydropower Station						
1) Utility civil works	68	105	172	76	45	121
2) Mechanical equipment	644	35	679	1,029	454	1,483
3) Electrical equipment	909	37	946	1,014 *Note 1	797	1,811
4) Instrumentation and control equipment	136	12	148	412	65	477
2. Vau i Dejes Hydropower Station						
1) Utility civil works	19	21	39	25	2	27
2) Mechanical equipment	777	85	862	629	204	833
3) Electrical equipment	692	13	705	1,012 *Note2	209	1,221
4) Instrumentation and control equipment	589	7	596	432	65	497
3. Contingencies	192	16	207	0	0	0
(JICA loan)	(80)	(0)	(80)	(0)	(0)	(0)
4. Tax and duties	0	33	33	0	0	0
Total	4,024	364	4,387	4,629	1,841	6,470
(Total of JICA loan)	(1,681)	(0)	(1,681)	(1,681)	(0)	(1,681)

Sources: JICA documents, Answers on Questionnaires

*Note 1) Total cost of the project at the time of the appraisal (partial) may not be consistent due to rounding.

*Note 2) Actual cost of the project for electrical equipment includes a portion covered by MCC (Fierza Hydropower Station, approx. 84 million yen, and Vau i Dejes Hydropower Station, approx. 261 million yen).

Tues, the project period was significantly higher than planned while the project cost was higher than planned, therefore efficiency of the project is low.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

With regards to evaluating the project effectiveness (quantitative evaluation), maximum output, net electric energy production, unplanned outage hours, etc. regarding both Fierza Hydropower Station and Vau i Dejes Hydropower Station were reviewed and analyzed.

1) Fierza Hydropower Station

Table 4 shows a transition of maximum output and actual net electric energy production regarding Fierza Hydropower Station. Disassembling and rehabilitation of four generator units began in 2003. Since one of the generator units was under rehabilitation each year, they produced 125MW less power, which is equivalent to the capacity of a generator unit, between 2003 and 2006.

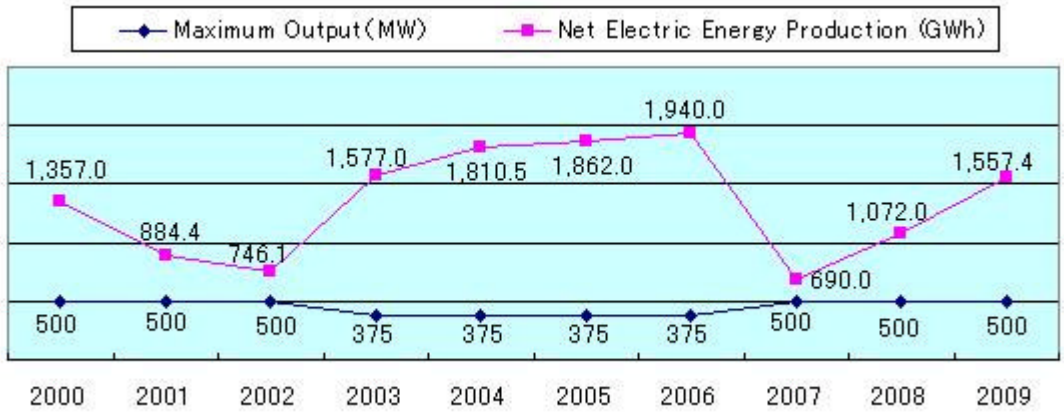
As shown in Table 4, annual average power generation varies widely by year. At the time of the appraisal, the project was predicted to improve their power generation by 417GWh. Before the project was implemented, actual power generation (annual average between 1981 and 1991) was 1,378GWh. Therefore, assuming the planned value as 1,795GWh, a total of those figures, the planned value was reached some years only before 2007 (the year the project completed). Nonetheless, it should be kept in mind that the above result does not necessarily show the actual effects of the rehabilitation, because power generation performance depends on factors that can greatly influence the figures such as amount of rainfall and dam flow (discharge), with or without instrument malfunctions.[10] For instance, the 2007–2008 figure shows a decrease in power generation despite virtual completion of the rehabilitation project. This can be explained by a breakdown[11] of the generator unit caused by a malfunction of an aged wall tube insulator[12]

[10] With regards to the point that the actual power generation (1,557.4 GWh) in Table 4 was almost the same as it was in the year 2003, the year before the implementation of the rehabilitation, it is because the Executing Agency adjusted the amount of the power generation from Fierza Hydropower Station for the purpose of securing the amount generated from the existing hydropower station in Drin River, Komani Hydropower Station (see Figure 1 on page 7), to some extent. Therefore, according to the Executing Agency, the actual power generation at Fierza Hydropower Station in 2003 did not become as high, although the rehabilitation had already ended.

[11] Despite the smooth progress of the rehabilitation work, operation of one of the generator units ceased due to the malfunction of an aged wall tube insulator installed in the step-up transformer of the No. 4 generator unit. This occurred between August and December 2007, causing a decrease in power generation. No major problems have

installed in the step-up transformer of the No. 4 generator unit as well as by a decrease in average flow rate per year (see Table 5).

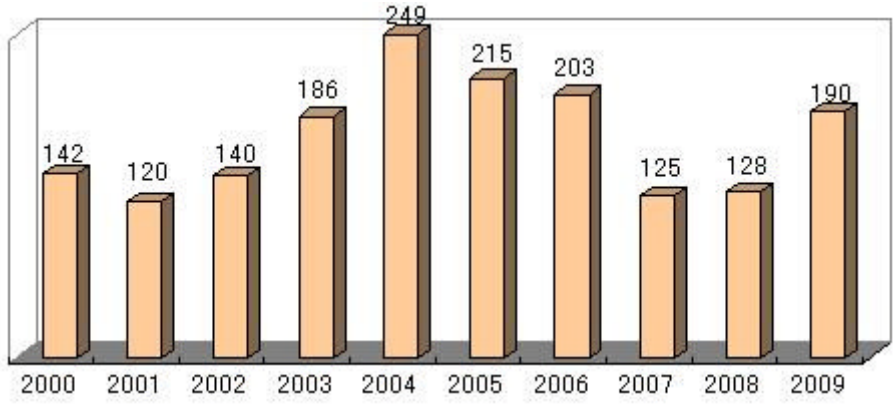
Table 4: Maximum Output and Actual Net Electric Energy Production Regarding Fierza Hydropower Station



Sources: Answers on Questionnaires

Table 5: Annual Average Water Inflow from the Reservoir Dam to Fierza Hydropower Station

(Unit: m³/sec.)



Sources: Executing Agency's documents

Unplanned outage hours totaled about 1,300 hours [13] before the commencement of rehabilitation (2000), while as shown in Table 6, unplanned outage hours after the rehabilitation

occurred after the rehabilitation work completed. It should be noted that the problematic wall tube insulator installed in the step-up transformer was not included in the entire rehabilitation project.

[12] It is a tube-shaped insulator made from insulating material such as porcelain, which is generally used as an external insulator for devices such as instrument transformers and breakers.

[13] According to the Executing Agency's data.

(2008–2009) have dramatically reduced to around 52–44 hours. This is because the frequency of failures/malfunctions was significantly reduced after rehabilitation of all generator units. The figure reached 4,832 hours per year in 2007 as described earlier, due to a malfunction of the wall tube insulator installed in the step-up transformer of the No. 4 generator unit. Following the completion of rehabilitating efforts, all generator units have been operating normally without any failures or malfunctions. Looking at the performance from 2005 through 2009 (aside from 2007), clear progress can be seen as generator units are rehabilitated one by one and unplanned outage hours decrease in proportion.

Table 6: Unplanned Outage Hours at Fierza Hydropower Station (Unit: hours/year)

	2005	2006	2007	2008	2009
Unplanned Outage Hours	329	172	4,832	44	52
(Outage Hours by Human Error)	0	0	0	0	0
(Outage Hours by Machine trouble)	329	172	4,832	44	52

Sources: Answers on Questionnaires

Figure 2: 220KV Isolator Switches
(Fierza Hydropower Station)

Figure 3: Generator Units
(Fierza Hydropower Station)

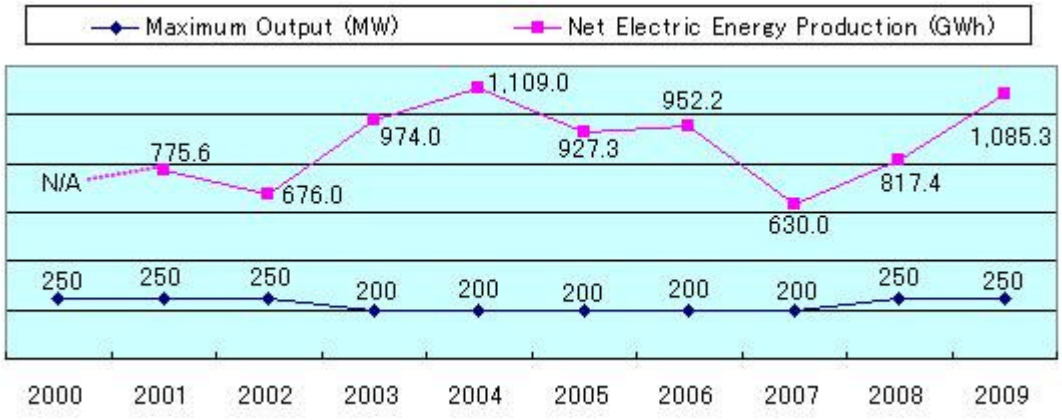
2) Vau i Dejes Hydropower Station

Table 7 shows a transition of maximum output and actual net electric energy production regarding Vau i Dejes Hydropower Station. Beginning from 2003, disassembling and rehabilitation of five generator units were implemented for this power station. Since one of the generator units was under rehabilitation in each year, power output (50MW) was decreased by a certain amount, equivalent to the capacity of one generator, between 2003 and 2007.

Like the Fierza Hydropower Station, Table 7 shows that annual average power generation widely varies year by year. At the time of the appraisal, it was predicted that the amount of power generation improved by this project would achieve 178GWh. Before the project

implementation, actual power generation was 878GWh (annual average of power generation between 1981 and 1991). Therefore, assuming the planned value as the total of those figures, 1,056GWh, the planned value was achieved in 2009[14] after the project completion in 2007. Nonetheless, it should be kept in mind that the above result does not necessarily show the actual effect of rehabilitation due to some fluctuant parameters, such as amount of rainfall and dam flow (discharge) and occurrence of instrument malfunction, that have a major influence on the figures. For instance, the 2005–2006 figure shows decrease in power generation (see Table 7) despite virtual completion of the rehabilitation project. This can be explained by the breakdown[15] of the generator unit caused by the malfunction of the aged wall tube insulator installed in the step-up transformer of the No. 2 generator unit, as well as by a decrease in average flow rate per year (see Table 8). Particularly during 2007–2008, a decrease in average flow rate per year (see Table 8) can be considered the sole cause.

Table 7: Maximum Output and Actual Net Electric Energy Production Regarding Vau i Dejes Hydropower Station

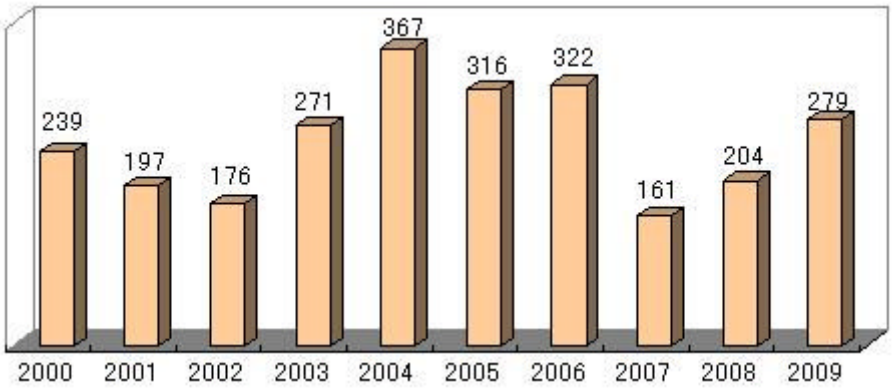


Sources: Answers on Questionnaires

[14] 1,085.3GWh was recorded.

[15] In June 2005, a malfunction of a wall tube insulator installed in the step-up transformer caused a fire. The transformer was set in a generator that connected to the No. 2 generator unit. (The suspected cause was an aged instrument.) Due to this accident, the entire generator units went into abeyance for nearly a month, and the No. 2 generator unit was in abeyance until March 2006. Since rehabilitation and inspection took place during this period, the power generation amount during 2005–2006 dropped in comparison with that of 2004. Like the situation at the Fierza Hydropower Station, it should be noted that the high-pressure wall tube insulator was not included in the rehabilitation target of the entire project. After the rehabilitation work completed, the entire generator unit has operated without problems.

Table 8: Annual Average Water Inflow from the Reservoir Dam to Vau i Dejes Hydropower Station (Unit: m³/sec.)



Sources: Executing Agency's documents

Unplanned outage hours totaled approximately 610 hours[16] before the commencement of rehabilitation (2000), while as shown in Table 9, those after the rehabilitation in 2008–2009 were dramatically reduced to around 73–44 hours. Like the Fierza Hydropower Station, this is because frequency of failure/malfunction dropped dramatically after the rehabilitation of all generator units. Looking at the performance of 2005 through 2009, a tendency can be seen: as the rehabilitation process of the generator unit progresses one by one, unplanned outage hours decreases in proportion. It should be noted that the reason for the increased outage hours during 2005–2006 (from 283 to 559 hours) was because of the complete outage of the No. 2 generator unit March 2006.

Table 9: Unplanned Outage Hours at Vau i Dejes Hydropower Station (Unit: hours/year)

	2005	2006	2007	2008	2009
Unplanned Outage Hours	283	559	81	73	44
(Outage hours by human error)	0	0	0	0	0
(Outage hours by machine trouble)	283	559	81	73	44

Sources: Answers on Questionnaires

[16] According to the Executing Agency's data.

Figure 4: Generator Units
(Vau i Dejes Hydropower Station)

Figure 5: Pipelines (bottom), Power Generation Building (center), and Substation Facilities (upper left)
(Vau i Dejes Hydropower Station)

3.3.1.2 Calculations of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

Recalculating the financial internal rate of return with 1) revenue by domestic electricity sales and 2) revenue by exports as the benefits and project construction costs, operational and maintenance expenses and taxes as the costs, and assuming a project life of 25 years, the result is 13.89%. It is a slightly lower figure than the 16.00% estimation figure at the time of the appraisal. The FIRR fell lower than the estimate because of the delay in project period and project costs which exceeded those of the original plan. (Additional explanation: since the unit price of electricity [sales price] increased from 4.40 lek/KWh at the time of the appraisal to 7.0–7.5 lek/KWh (2007–2009 actual), it is considered that there is a positive influence on the result of the recalculation of FIRR, because a certain amount of profit was secured through an increase in the unit price.)

(2) Economic Internal Rate of Return (EIRR)

Recalculating the economic internal rate of return with 1) revenue by domestic electricity sales and 2) revenue by exports as the benefits and project construction costs and operational and maintenance expenses as the costs, and assuming a project life of 25 years, the result is 21.92%. It is a lower figure than the 29.00% estimation figure at the time of the appraisal. The EIRR result is lower than the estimate because of the delay in project period and the project cost which exceeded that of the original plan.

3.3.2 Qualitative Effects

(1) Project Life about the Hydropower Stations

Compared to the situation before the rehabilitation, when Fierza and Vau i Dejes hydropower stations suffered from frequent failure and malfunctions, the project life is thought to be improved because the proper operation and maintenance have been carried out at both stations. According to the Executing Agency, the project life has been prolonged after the completion of the rehabilitation due to the drastic decreases in the frequency of turbine outages, rehabilitation time, and length of downtime. If properly maintained in the future, it is likely that the hydropower stations can remain in operation for 50 years or more.

(2) Improvement of Work Environment (Safety)

It is believed that the work environment (in terms of safety) for staff has also improved since the completion of the rehabilitation. Technical staff at the hydropower stations commented in an interview, “We have been working earnestly and thoroughly on safety management even after the completion of the rehabilitation. Our work environment has improved thanks to the introduction of the latest instruments, which realized higher work efficiency.”

(Determination of the Effectiveness Rating and Conclusions)

Because of the character of the project (rehabilitating hydropower stations), effectiveness of the project should be primarily determined by looking at the increase/decrease in hours and failure/malfunction occurrence. A dramatic reduction in frequency has been observed in unplanned outage hour data for the Fierza and Vau i Dejes hydropower stations after the completion of the rehabilitation project, which proves that the project has had a positive effect. Therefore, this project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

3.4.1.1 Impact on the Stabilization of Electricity Supply

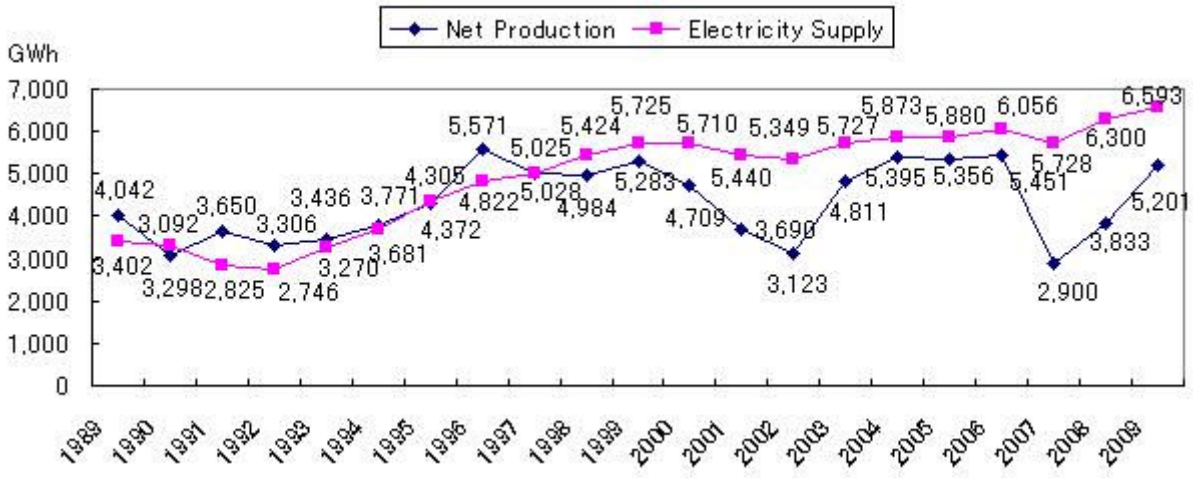
This project was implemented with the purpose of stabilizing the electricity supply by rehabilitating hydropower stations, the main power sources for Albania. Table 10 shows the country’s power consumption (power demand) and actual power production from five years prior to the project commencement to 2009. At the time of the appraisal, power demand was

estimated to grow by 1.5% or so every year after 1995. Albania's power demand has roughly trended upward since the time of the appraisal, while power production varies year by year. After around 1997, power demand began to exceed production; however, as described in 3.4.1.2, the country has imported electricity (purchased power) from neighboring countries to make up for deficiencies.

Currently, Albania's total domestic power production capacity is 1,557MW, whereas the sum total of the Fierza and Vau i Dejes hydropower stations accounts for nearly half of the country's entire power production capacity (500MW+250MW=750MW). Therefore, the impact of this rehabilitation project on domestic power supply can be considered enormous. If the rehabilitation project had not been implemented, generator units at the two stations would have faced more frequent failures/malfunctions than they had at the time of appraisal, and power production would have been much lower. Therefore, the project is considered to have had a positive impact on Albania's domestic power supply system by achieving normal operation of the two power stations, and by reducing generation unit downtime triggered by failures/malfunctions significantly.

Table 10: Transition of Net Production and Electricity Supply of the Whole Country

(Unit: GWh)



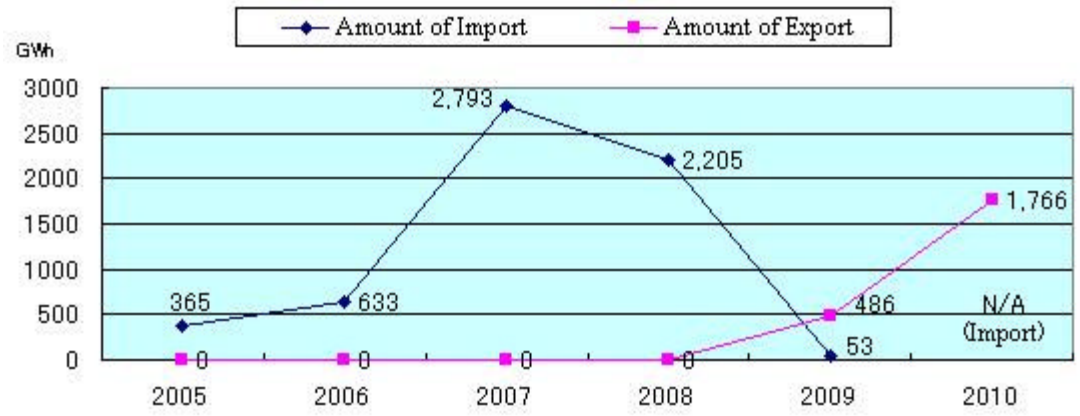
Sources: JICA documents, Answers on Questionnaires, Energy Regulatory Entities

3.4.1.2 Impact on Export, Import, and Trade Balance of Power

At the time of the appraisal, the project purpose included meeting Albania's domestic power demand and exporting electricity abroad for a certain period[17] by rehabilitating existing domestic hydropower stations to prolong the lives of their facilities. In terms of the trade balance, power production was always behind domestic power consumption in Albania until 2009, and as shown in Table 11, the country had imported electricity (purchased power) from neighboring countries to supply a deficiency in domestic demand. However, during the rainy season between October 2009 and April 2010, the country was able to produce electricity exceeding the domestic demand thanks to high rainfall. Since the end of 2009 through the first half of 2010, electricity export (selling of electricity) has generated profit as shown in Table 12.

As stated earlier, if this rehabilitation project had not been implemented, failures/malfunctions of the generator units at the existing hydropower stations would have occurred more frequently. Therefore, the rehabilitation project is thought to have brought benefits such as securing rainfall and dam flow (discharge) along with normal operation of power stations, thereby further contributing to Albania's ability to successfully export electricity to other countries.

Table 11: Transition of Albania's Electricity Export and Import Amount (Unit: GWh)

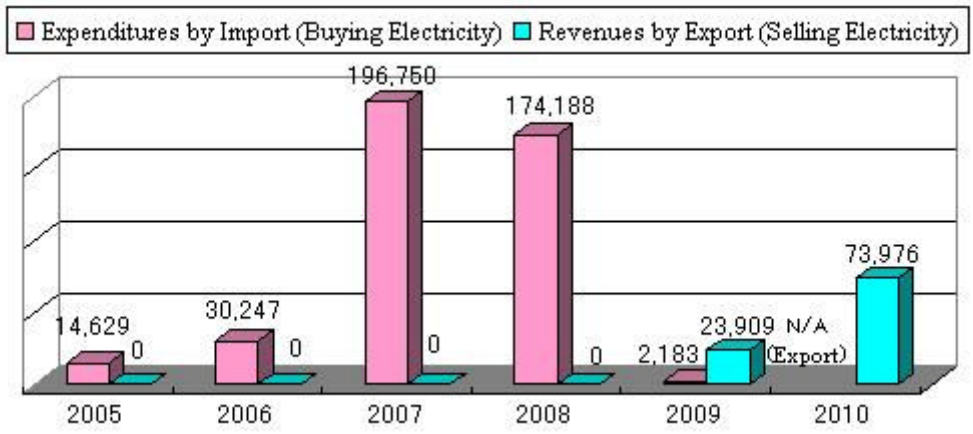


Sources: Executing Agency's documents
Note 1) Data about amount of export in 2010 is at the time of field survey (at the end of June 2010).
Note 2) Electricity export did not occur from the end of 1990 to 2004.

[17] According to JICA's appraisal documents.

Table 12: Transition of Albania's Expenditures by Import and Revenues by Export

(Unit: 1,000 Euro)

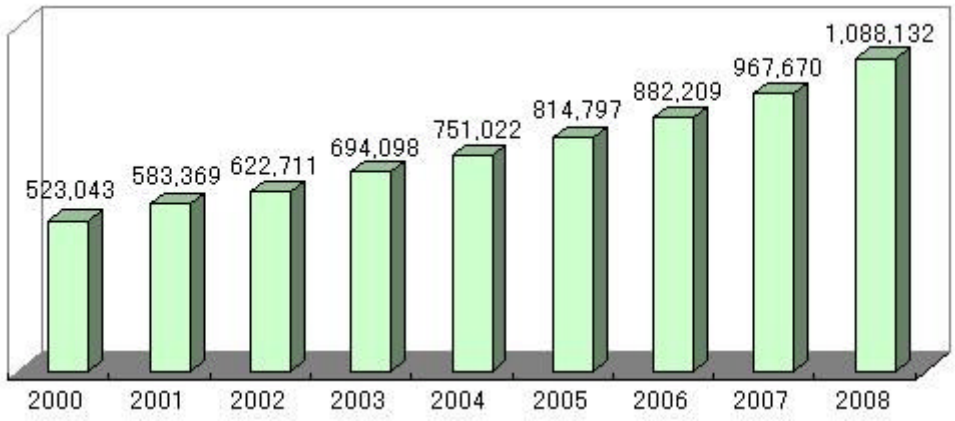


Sources: Executing Agency's documents
Note 1) Data about amount of export in 2010 is at the time of field survey (at the end of June 2010).
Note 2) Electricity export did not occur from the end of 1990 to 2004.

3.4.1.3 Impact on Economic Development

Table 13 shows Albania's Gross Domestic Product (GDP) after 2000. The GDP shows an upward trend after that year. Various factors other than this project have an influence on the economic growth of the country. However, the completion of the rehabilitation on the two hydropower stations seems to have provided a significant improvement of the power supply of Albania, since these two stations account for nearly half of the country's entire power production. Thus, it is assumed that the project is directly or indirectly supporting the people's life environment and economic activities.

Table 13: Transition of Albania's Gross Domestic Product (GDP) (Unit: million Leke)



Sources: Executing Agency's documents and Albanian Statistics Bureau

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

There was no negative impact on the environment by the project.[18] Furthermore, noise and vibration were not particular concerns as the two power stations are located in isolated mountain areas.

Figure 6: Intake
(Reservoir Dam at Fierza Hydropower Station)

Figure 7: Electrical Equipment Rehabilitated by JICA Loan (Vau i Dejes Hydropower Station)

3.4.2.2 Land Acquisition and Resettlement

As a result of the interviews with the Executing Agency and the field survey, it was confirmed that no resettlement and land acquisition occurred, as the project only involved rehabilitation of the existing hydropower stations.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

The Executing Agency at the time of the ex-post evaluation was the Albanian Power Corporation (KESH).[19] In 2003, the Albanian government restructured KESH with the purpose of facilitating the entry of private sectors into the power industry. As a part of its activities, although KESH continued to be involved in the power generation project, the power transmission/distribution sector was separately handed over to two newly established organizations in 2006: the Transmission System Operator (OST) and the Distribution System Operator (DSO). KESH and these two organizations came under the jurisdiction of the Ministry

[18] At the time of the field study, no major negative impact on the natural environment was observed. According to KESH, there was no need to implement the Environment Impact Assessment (EIA) because of the rehabilitative nature of this project.

[19] KESH has recently come under the control of the Ministry of Economy, Trade and Energy (METE). METE is assigned jurisdiction over all commissioners of the monitoring committee, a higher policymaking institution of KESH. This means that the General Director of KESH is appointed by the monitoring committee.

of Economy, Trade and Energy (METE). However, the privatization of the DSO was initiated under the guidance of the International Finance Corporation (IFC), and in 2009, the Albanian government signed an agreement with a Czech corporation regarding the DSO's project operation and sharing profit. As a result, DSO was privatized and the said Czech corporation is currently in charge of the power distribution project.

The number of KESH's employees was 9,500 at the time of the appraisal, which fell to 1,250 by the time of the ex-post evaluation (June 2010). The major reason for the drop in the number of employees is the separation of the power transmission/distribution sector (as described above). As a result, the organization is now only in charge of the power generation sector. According to KESH, the current number of employees is reasonable to implement the project.

The following outlines work descriptions, number of staff, and organization of the operation and maintenance departments of this project at the time of the ex-post evaluation. It can be judged that there are no problems with the structural aspects of operation and maintenance at the Fierza and Vau i Dejes hydropower stations and that the number of staff is sufficient.

1) Both of the power stations have operation and maintenance departments, which take charge of operation and maintenance, respectively. The number of staff in these departments are 62 and 55 in the Fierza Hydropower Station and 52 and 68 in the Vau i Dejes Hydropower Station, respectively.

2) The Department of Operation is in charge of operations related to the starting/stopping of generator units, where the data of various instruments and equipments including generator units and transformers is measured and relevant operations are monitored.

3) The Department of Maintenance has three subsidiary groups: the Machinery Section, Power Section, and Hydro-technology Section. Periodic maintenance on generators and peripheral facilities and rehabilitation for failures/malfunctions are conducted.

3.5.2 Technical Aspects of Operation and Maintenance

The Human Resources Department at KESH is mainly in charge of conducting staff courses and training programs at the hydropower stations. In 2004, during the project implementation, a training program called Control Monitoring System Training for power generation and

transforming was held in France.[20] Nine staff from Fierza Hydropower Station and eight from Vau i Dejes Hydropower Station participated in the training. In 2009, after the completion of the rehabilitation, training programs called Power Station Operation Techniques Training and Safety Issues and Maintenance Technique Training were held in Italy.[21] Three members from each power station participated in these trainings. The two power stations have a significant number of experienced staff who provide OJT training for new members as needed. Furthermore, it was observed during the field survey that skilled staff are assigned to the appropriate works in both stations. Based on the above, it can be judged that the technical level of the hydropower stations with regards to operation and maintenance is sufficient.

3.5.3 Financial Aspects of Operation and Maintenance

Table 14 explains operation and maintenance budget regarding the project. Rehabilitation of the Fierza and Vau i Dejes hydropower stations were completed in February 2007 and October 2007, respectively. After the project completion, no financial deficit was observed in the operation and maintenance budget. According to the staff from KESH and the hydropower stations, both stations receive nearly the full amount of necessary budget they requested from KESH. Therefore, it can be judged that there is no problem regarding the finances for the operation and maintenance of the both stations.

Table 14: Operation and Maintenance Budget at Fierza and Vau i Dejes Hydropower Station (Unit: 1,000 Lek)

	Fierza Hydropower Station			Vau i Dejes Hydropower Station		
	2007	2008	2009	2007	2008	2009
Operational Budget	136,549	139,529	148,137	165,760	147,075	135,153
Maintenance Budget	28,800	28,604	28,420	14,093	25,822	40,529
Total	165,349	168,133	176,557	179,853	172,897	175,682

Sources: Answers on Questionnaires

3.5.4 Current Status of Operation and Maintenance

The status of operation and maintenance regarding the main facilities at Fierza Hydropower Station and Vau i Dejes Hydropower Station can be described as follows. Periodical maintenance is being implemented. Spare parts are also being procured and stored appropriately.

[20] Alstom, a French contractor of this project, offered the training for staff from both stations.
[21] Similarly, AEM Milano, an Italian corporation, offered the training for staff from both stations.

In addition, manuals regarding operation and maintenance are being prepared. It is evident that there are no problems with the status of operation and maintenance at the hydropower stations.

1) Control Room

Compared to the situation before the completion of the rehabilitation project, performance of the control/monitoring systems has been improved and the generator/substation and water intake, etc. has been controlled/managed more smoothly. The staff works on a three-shift system around the clock. After the completion of the rehabilitation, no failure/malfunction of the control panel or other instruments including computers has been reported. (Rehabilitation of the control and monitoring systems and instruments was implemented mainly with the help of the EBRD loan.)

2) Generator Chamber/Generator Units

The generator units have been working normally thanks to the full-scale inspection and maintenance that take place once a year. According to the staff working at the power stations, the generator units suffered from frequent failures/malfunctions and prolonged abeyance in operation due to the aged instruments before the completion of the rehabilitation. However, no mechanical problems resulting in abeyance in operation have been reported since then. (Rehabilitation of the generator units was implemented with the help of Swiss and Austrian grant aids and JICA loan. Rehabilitation of the electrical devices in the generator chamber and test for the generator units were implemented through the JICA loan.)

3) Substation Facilities

For both power stations, substation facilities are located adjacent to the power generation building. Instruments such as disconnecting switches, which were the targets of rehabilitation, have been working normally, and no particular problems have been observed. (Regarding the substation facilities, rehabilitation of the electric devices was funded by the JICA loan and construction of the ground facilities was funded by the EBRD loan.)

4) Intake

Since no malfunctions in opening/closing or the control system of the intake gate were found, it can be deemed that there are no mechanical problems[22] at this facility. (Rehabilitation of the control unit and other instruments installed within the intake facility

[22] However, as of now, the spillway tower installed at reservoir dam has been degrading. According to KESH, rehabilitation is planned in the near future.

was implemented primarily through the EBRD loan.)

Figure 8: Control Room
(Fierza Hydropower Station)

Figure 9: Generator Step-up Transformer[23]
(Adjacent to Power Generation Building at Fierza Hydropower Station)

In relation to the above, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is in compliance with development policy and needs. Although the period of the project implementation took much longer and project costs were higher than initially planned, outputs were generally constructed according to plan. Furthermore, expected effects of the project such as a drastic reduction in unplanned outage hours due to failures/malfunctions have been achieved. In addition, the capacity of technical staff and maintenance budget are sufficient, and no problems were seen with respect to operation and maintenance.

In light of the above, this project is evaluated to be satisfactory (B).

4.2 Recommendations

None

4.3 Lessons Learned

Immediately after the project commencement, EBRD, a primary donor in this project, held financing and loans in abeyance due to the inferior performance of KESH such as high transmission loss rate, low performance in collecting power charges, etc. This led the Executing Agency to adjust their work schedule including the timing of the loading because the JICA loan

[23] As described on page 9, a wall tube insulator of the step-up transformer failed in 2007 and was repaired. As of now, the insulator is working properly.

portion (electrical equipment and devices, etc.) had to be correlated with the progress of the EBRD loan portion (control and monitoring systems). This caused a significant delay in the project completion compared to the initial plan. Therefore, as lessons learned, if multiple donors are involved, the donors should carefully discuss matters where a dispute or discontent may arise over a party's policy, to avoid a delay in the project schedule and to improve the performance as much as possible. Project delay might result in additional costs; moreover, in a situation that involves power shortages, it will greatly affect people's lives and cause economic losses. From that point of view, it is believed that the extent of the impact will not be so small.

Comparison of the Original and Actual Scope of the Project

Items	Original	Actual
1. Project Outputs	(Fierza Hydropower Station) --- The Entire Project--- 1) Utility civil works (ground utilities) ->EBRD loan and Albania's own funds 2) Mechanical equipment (intake, conduit, new runners, etc.) ->Grant aid from the Swiss government 3) Electrical equipment ->JICA loan 4) Instrumentation and control ıipment ->EBRD loan --- JICA Loan --- - Testing and upgrading of unit-transformers - Rewinding and stacking of 2 generator units - Testing of generator units - Replacement of excitation for 4 units - Upgrading of cooling system for 2 generators - Replacement of 220KV isolator switches (18x) - Improvement of A.C. and D.C. system - Upgrading of illumination system - Procurement of spare parts - Procurement of emergency diesel generator	As planned

	(Vau i Dejes Hydropower Station) --- The Entire Project--- 1) Utility civil works (ground utilities) ->EBRD loan and Albania's own funds 2) Mechanical equipment (intake, conduit, new runners, etc.) -> Grant aid from Austrian government 3) Electrical equipment ->JICA loan 4) Instrumentation and control ıipment ->EBRD loan --- JICA Loan--- - Testing and upgrading of unit-transformers - Replacement of unit protection system - Replacement of excitation systems - Replacement of A.C. and D.C. system - Replacement of 4 x 220kV-bays -Replacement of 1 x 110KV-bays - Upgrading of cooling system for 5 units - Testing of generator units - Improvement of illumination system - Procurement of spare parts - Procurement of emergency diesel generator	
	(Consulting Services) - To be implemented with funds provided by EBRD. Activities include project preparation, tender evaluation, management of utility civil works, etc. (223M/M)	As planned (232M/M: slightly exceeded the planned value)
2. Project Period	November 1995 - September 1999 (47 months)	November 1995 - October 20007 (144 months)
3. Project Cost Amount paid in Foreign currency Amount paid in Local currency Total	 4,024 million yen 324 million yen 4,387 million yen	 4,629 million yen 1,841 million yen 6,470 million yen

Japanese ODA loan portion	1,681 million yen	1,681 million yen
Exchange Rate	1 ECU=122 yen (1 USD= 91 Lek) (As of November 1995)	1 EURO=141.97 yen (1 USD=106.44 Lek) (Average between January 2003 and October 2007)